

## AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

### Listing of Claims:

Claim 1 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound comprising:

- a) reacting methyl acrylate with an alkylphenol compound in the presence of a first catalyst to form a methyl ester intermediate compound,
- b) reacting an alcohol having at least 2 carbon atoms with the methyl ester intermediate compound in the presence of a second catalyst to form the hindered phenolic alkyl ester compound,
- c) neutralizing any catalyst residue with an aqueous phosphoric acid to form a precipitated phosphate salt, and
- d) separating the precipitated phosphate salt from the hindered phenolic alkyl ester compound,

wherein said first catalyst and said second catalyst are the same or different and comprise at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.

Claim 2 (Previously presented). The method according to claim 1, wherein the first and second catalysts have the same chemical composition.

Claim 3 (Previously presented). The method according to claim 1, wherein the first and second catalysts have different chemical compositions.

Claim 4 (Previously presented). The method according to claim 1, wherein the first catalyst is also used as the second catalyst during the reaction of the alcohol with the methyl ester intermediate compound.

Claim 5 (Currently amended). The method according to claim 1, wherein the first and second catalysts comprise at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, ~~alkali metal hydrides, alkali metal alkoxides,~~

~~alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.~~

Claim 6 (Previously presented). The method according to claim 1, wherein the first and second catalysts comprise at least one compound selected from the group consisting of potassium hydroxide, sodium hydroxide, lithium hydroxide, cesium hydroxide, calcium hydroxide, magnesium hydroxide, dibutyltin oxide, and mixtures thereof.

Claim 7 (Previously presented). The method according to claim 1 wherein filtration is used to separate the precipitated phosphate salt from the hindered phenolic alkyl ester compound.

Claim 8 (Previously presented). The method according to claim 1, wherein the hindered phenolic alkyl ester compound is formed in a liquid form.

Claim 9 (Previously presented). The method according to claim 1, wherein the alkylphenol compound is 2,6-di-tert-butylphenol.

Claim 10 (Previously presented). The method according to claim 1, wherein the hindered phenolic alkyl ester compound formed is 3,5-di-tert-butyl-4-hydroxyhydrocinnamic acid, alkyl ester.

Claim 11 (Previously presented). The method according to claim 1, wherein the molar ratio of methyl acrylate to alkylphenol is at least 1:1.

Claim 12 (Previously presented). The method according to claim 1, wherein a molar excess of methyl acrylate is employed so that the molar ratio of methyl acrylate to alkylphenol is greater than 1:1.

Claim 13 (Previously presented). The method according to claim 1, wherein a molar excess of methyl acrylate is employed so that the molar ratio of methyl acrylate to alkylphenol is between about 1.05:1 to about 1.30:1.

Claim 14 (Previously presented). The method according to claim 1, wherein a molar excess of alkylphenol is employed so that the molar ratio of alkylphenol to methyl acrylate is greater than 1:1.

Claim 15 (Previously presented). The method according to claim 1, wherein a molar excess of alkylphenol is employed so that the molar ratio of alkylphenol to methyl acrylate is between about 1.05:1 to about 1.30:1.

Claim 16 (Previously presented). The method according to claim 1, wherein the phosphoric acid comprises at least one compound selected from the group consisting of orthophosphoric acid ( $\text{H}_3\text{PO}_4$ ), pyrophosphoric acid ( $\text{H}_4\text{P}_2\text{O}_7$ ), metaphosphoric acid ( $\text{HPO}_3$ ), phosphorous acid ( $\text{H}_3\text{PO}_3$ ), and  $\text{H}_2\text{PO}_4$ , and mixtures thereof.

Claim 17 (Previously presented). The method according to claim 1, wherein the molar equivalent of aqueous phosphoric acid used is between about 10% and 200% of the total amount of catalysts used.

Claim 18 (Previously presented). The method according to claim 1, wherein the molar equivalent of aqueous phosphoric acid used is between about 33% and 100% of the total amount of catalysts used.

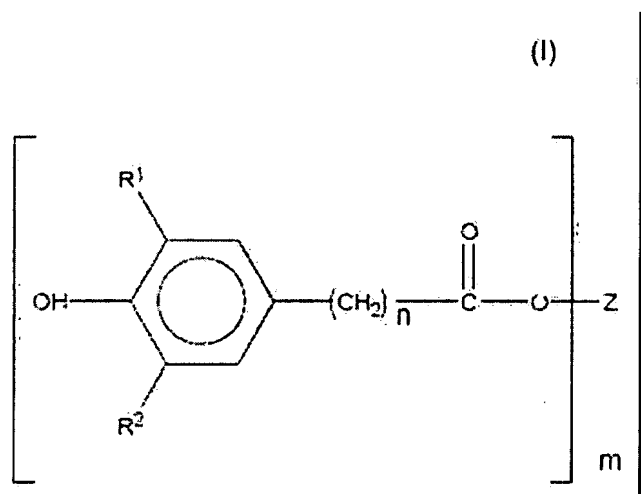
Claim 19 (Previously presented). The method according to claim 1, wherein the alcohol is a high molecular weight alcohol.

Claim 20 (Previously presented). The method according to claim 1, wherein the methyl acrylate is reacted with the alkylphenol compound in the presence of a promoter.

Claim 21 (Currently amended). The method according to claim 20, wherein the promoter ~~comprises~~ is at least one compound selected from the group consisting of dialkyl sulfoxides, dialkyl formamides, dialkyl ethers, dimethyl acetamide, N,N-dialkyl acidamide, methyl ethyl ketone, methyl butyl ketone, phase transfer agents, crown ethers, and mixtures thereof.

Claim 22 (Previously presented). The method according to claim 20, wherein the promoter is tetrahydrofuran.

Claim 23 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound having the structure according to Formula I:



wherein:

$\text{R}^1$  and  $\text{R}^2$  are independently selected from the group consisting of H, alkyl, cycloalkyl, aryl, alkylaryl, and arylalkyl;

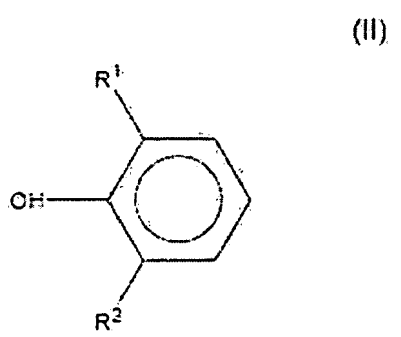
$n$  is 2;

$m$  is 1, 2, 3, or 4; and

$Z$  is alkyl;

comprising the steps of:

a) reacting methyl acrylate with an alkylphenol compound in the presence of a first catalyst to form a methyl ester intermediate compound, wherein the alkylphenol compound has the structure according to Formula II:



and wherein  $\text{R}^1$  and  $\text{R}^2$  are defined as above;

b) reacting an alcohol having at least 2 carbon atoms with the methyl ester intermediate compound in the presence of a second catalyst to form the hindered phenolic alkyl ester compound having the structure according to Formula I, and

- c) neutralizing the catalyst residue with an aqueous phosphoric acid to form a precipitated phosphate salt, and
- d) separating the precipitated phosphate salt from the hindered phenolic alkyl ester compound,

wherein said first catalyst and said second catalyst are the same or different and comprise at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarboxides, and mixtures thereof.

Claim 24 (Previously presented). The method according to claim 23, wherein  $R^1$  and  $R^2$  are alkyl.

Claim 25 (Previously presented). The method according to claim 23, wherein  $R^1$  and  $R^2$  are independently selected from t-butyl and  $C_1$ - $C_6$  alkyl.

Claim 26 (Previously presented). The method according to claim 23, wherein  $R^1$  and  $R^2$  are t-butyl.

Claim 27 (Previously presented). The method according to claim 23, wherein Z is  $C_2$ - $C_{20}$  alkyl.

Claim 28 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound comprising:

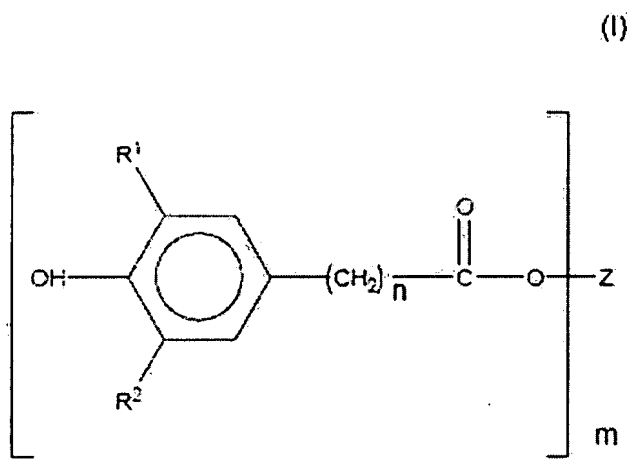
- a) reacting methyl acrylate with an alkylphenol compound in the presence of a first catalyst to form a methyl ester intermediate compound,
- b) reacting an alcohol having at least 2 carbon atoms with the methyl ester intermediate compound in the presence of a second catalyst to form the hindered phenolic alkyl ester compound, wherein the second catalyst has the same chemical composition as the first catalyst,
- c) neutralizing the first and second catalysts with an aqueous acid to form a precipitated salt, wherein the aqueous acid comprises at least one compound selected from the group consisting of sulfuric acid, phosphoric acid, and mixtures thereof, and
- d) separating the precipitated salt from the hindered phenolic alkyl ester compound,

wherein said first catalyst and said second catalyst comprise at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarboxides, and mixtures thereof.

Claim 29 (Previously presented). The method according to claim 28, wherein the first catalyst is also used as the second catalyst during the reaction of the alcohol with the methyl ester intermediate compound.

Claim 30 (Previously presented). The method according to claim 28, wherein the aqueous acid comprises at least one compound selected from the group consisting of orthophosphoric acid ( $\text{H}_3\text{PO}_4$ ), pyrophosphoric acid ( $\text{H}_4\text{P}_2\text{O}_7$ ), metaphosphoric acid ( $\text{HPO}_3$ ), phosphorous acid ( $\text{H}_3\text{PO}_3$ ), and  $\text{H}_2\text{PO}_4$ , and mixtures thereof.

Claim 31 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound having the structure according to Formula I:



wherein:

$\text{R}^1$  and  $\text{R}^2$  are independently selected from the group consisting of H, alkyl, cycloalkyl, aryl, alkylaryl, and arylalkyl;

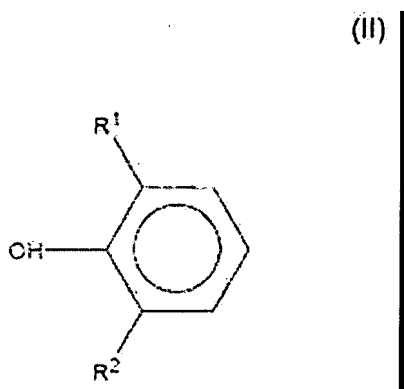
$n$  is 2;

$m$  is 1, 2, 3, or 4; and

$Z$  is alkyl;

comprising the steps of:

a) reacting methyl acrylate with an alkylphenol compound in the presence of a first catalyst to form a methyl ester intermediate compound, wherein the alkylphenol compound has the structure according to Formula II:



and wherein R<sup>1</sup> and R<sup>2</sup> are defined as above;

b) reacting an alcohol having at least 2 carbon atoms with the methyl ester intermediate compound in the presence of a second catalyst to form the hindered phenolic alkyl ester compound having the structure according to Formula I, wherein the second catalyst has the same chemical composition as the first catalyst;

c) neutralizing the first and second catalysts with an aqueous acid to form a precipitated salt, wherein the aqueous acid comprises at least one compound selected from the group consisting of sulfuric acid, phosphoric acid, and mixtures thereof, and

d) separating the precipitated salt from the hindered phenolic alkyl ester compound,  
wherein said first catalyst and said second catalyst comprise at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.

Claim 32 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound comprising:

a) reacting methyl acrylate with an alkylphenol compound in the presence of a promoter and a first catalyst to form a methyl ester intermediate compound,

b) reacting an alcohol having at least 2 carbon atoms with the methyl ester intermediate compound in the presence of a second catalyst to form the hindered phenolic alkyl ester compound, wherein the hindered phenolic alkyl ester compound is formed in a liquid form,

c) neutralizing any catalyst residue with an aqueous acid to form a precipitated salt, wherein the aqueous acid comprises at least one compound selected from the group consisting of sulfuric acid, phosphoric acid, and mixtures thereof, and

d) separating the precipitated salt from the hindered phenolic alkyl ester compound, wherein said first and said second catalyst are the same or different and comprise at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.

Claim 33 (Currently amended). The method according to claim 32, wherein the promoter ~~comprises~~ is at least one compound selected from the group consisting of dialkyl sulfoxides, dialkyl formamides, dialkyl ethers, dimethyl acetamide, N,N-dialkyl acidamide, methyl ethyl ketone, methyl butyl ketone, phase transfer agents, crown ethers, and mixtures thereof.

Claim 34 (Previously presented). The method according to claim 32, wherein the promoter comprises at least one compound selected from the group consisting of dimethyl sulfoxide, dimethyl formamide, diethyl ether, diisopropyl ether, and mixtures thereof.

Claim 35 (Previously presented). The method according to claim 32, wherein the promoter is tetrahydrofuran.

Claim 36 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound comprising:

a) reacting methyl acrylate with an alkylphenol compound in the presence of tetrahydrofuran and a first catalyst to form a methyl ester intermediate compound,

b) reacting an alcohol having at least 2 carbon atoms with the methyl ester intermediate compound in the presence of a second catalyst to form the hindered phenolic alkyl ester compound,

c) neutralizing any catalyst residue with an aqueous acid to form a precipitated salt, wherein the aqueous acid comprises at least one compound selected from the group consisting of sulfuric acid, phosphoric acid, and mixtures thereof, and

d) separating the precipitated salt from the hindered phenolic alkyl ester compound, wherein said first and said second catalyst are the same or different and comprise at least one compound selected from the group consisting of alkali and alkaline earth metal



hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.

Claim 37 (Previously presented). The method according to claim 36, wherein the alcohol is reacted with the methyl ester intermediate compound in the presence of tetrahydrofuran.

Claim 38 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound comprising:

- a) reacting an alkyl acrylate with an alkylphenol compound in the presence of a catalyst to form the hindered phenolic alkyl ester compound,
- b) neutralizing the catalyst with an aqueous acid to form a precipitated salt, wherein the aqueous acid comprises at least one compound selected from the group consisting of sulfuric acid, phosphoric acid, and mixtures thereof, and
- c) separating the precipitated salt from the hindered phenolic alkyl ester compound by filtration,

wherein said catalyst comprises at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.

Claim 39 (Previously presented). The method according to claim 38, wherein the alkyl acrylate is methyl acrylate.

Claim 40 (Previously presented). The method according to claim 38, wherein the alkyl acrylate is a high molecular weight alkyl acrylate.

Claim 41 (Previously presented). The method according to claim 40, wherein the high molecular weight alkyl acrylate is a C<sub>2</sub>-C<sub>10</sub> alkyl acrylate.

Claim 42 (Previously presented). The method according to claim 41, wherein the C<sub>2</sub>-C<sub>10</sub> alkyl acrylate is a compound selected from the group consisting of n-butyl acrylate, sec-butyl acrylate, n-octyl acrylate, 2-ethylhexyl acrylate, isoheptyl acrylate, isooctyl acrylate, isononyl acrylate, isodecyl acrylate, and mixtures thereof.

Claim 43 (Previously presented). The method according to claim 38, wherein the hindered phenolic alkyl ester compound is formed in a liquid form.

Claim 44 (Previously presented). The method according to claim 38, wherein the alkyl acrylate is reacted with the alkylphenol compound in the presence of an alcohol.

Claim 45 (Previously presented). The method according to claim 44, wherein the alcohol is a high molecular weight alcohol.

Claim 46 (Previously presented). The method according to claim 38, wherein the alkyl acrylate is reacted with the alkylphenol compound in the presence of a promoter.

Claim 47 (Previously presented). The method according to claim 46, wherein the promoter comprises at least one compound selected from the group consisting of dialkyl sulfoxides, dialkyl formamides, dialkyl ethers, dimethyl acetamide, N,N-dialkyl acidamide, methyl ethyl ketone, methyl butyl ketone, phase transfer agents, crown ethers, and mixtures thereof.

Claim 48 (Previously presented). The method according to claim 46, wherein the promoter is tetrahydrofuran.

Claim 49 (Previously presented). The method according to claim 38, wherein the aqueous acid comprises the phosphoric acid.

Claims 50-68 (Withdrawn).

Claim 69 (Currently amended). A method for the production of a hindered phenolic alkyl ester compound consisting essentially of:

- a) reacting an alkyl acrylate with an alkylphenol compound in the presence of a catalyst to form the hindered phenolic alkyl ester compound,
- b) neutralizing the catalyst with an aqueous acid to form a precipitated salt, wherein the aqueous acid comprises at least one compound selected from the group consisting of sulfuric acid, phosphoric acid, and mixtures thereof, and
- c) separating the precipitated salt from the hindered phenolic alkyl ester compound by filtration,

wherein said catalyst comprises at least one compound selected from the group consisting of alkali and alkaline earth metal hydroxides and oxides, alkali metal hydrides, alkali metal alkoxides, alkali metal amides, zinc salts, calcium salts, monoalkyltins, alkali metal hydrocarbyloxides, and mixtures thereof.